

CLAIMS

1. A piezoelectric actuator for generating pressure in each pressure chamber of a pressure chamber forming unit in which pressure chambers formed of multiple concave parts are provided on one surface, comprising:

a vibration layer arranged on said one surface of said pressure chamber forming unit covering each said pressure chamber;

a lower electrode layer formed of conduction materials laminated on said vibration layer;

the first piezoelectric layer laminated on said lower electrode layer, formed of piezoelectric materials polarized in the direction of its thickness having the size to cover multiple said pressure chambers; and

an upper electrode layer formed of conduction materials laminated on said first piezoelectric layer; and characterized by:

at least either said upper electrode layer or said lower electrode layer is formed of multiple electrodes separated and formed corresponding to each said pressure chamber of the pressure chamber forming unit.

2. A piezoelectric actuator as defined in Claim 1, characterized by:

said vibration layer, said lower electrode layer, said first piezoelectric layer and said upper electrode layer are successively laminated and formed by using the predetermined

multi-layer plate manufacturing process.

3. A piezoelectric actuator as defined in Claim 1,
characterized by:

one surface side of the first piezoelectric layer on which
said upper electrode layer is laminated and formed is separated
corresponding respectively to each said electrode of the upper
electrode layer and/or the lower electrode layer.

4. A piezoelectric actuator as defined in Claim 1,
characterized by:

said vibration layer, comprising;
the second piezoelectric layer formed of piezoelectric
materials laminated under said lower electrode layer.

5. A piezoelectric actuator as defined in Claim 4,
characterized by:

said vibration layer comprising;
an electrode layer formed of conduction materials laminated
under the second piezoelectric layer.

6. A piezoelectric actuator as defined in Claim 1,
characterized by:

said vibration layer comprising;
a ceramic layer formed of ceramic materials laminated under

said lower electrode layer.

7. A piezoelectric actuator as defined in Claim 1, characterized by:

said vibration layer is comprised of a part of said lower electrode layer.

8. A piezoelectric actuator manufacturing method for generating pressure in each said pressure chamber of the pressure chamber forming unit on which pressure chambers formed of multiple concave parts are provided on one surface, comprising:

the first process for forming the first sheet formed of pliant piezoelectric materials and the second sheet formed of pliant predetermined materials, forming the upper electrode layer formed of conduction materials on one surface of said first sheet, and forming the lower electrode layer formed of conduction materials on the other surface of said first sheet or one surface of said second sheet;

the second process for piling and densifying said first and the second sheets having said lower electrode layer between;

the third process for polarizing said first sheet in the direction of its thickness; and

the fourth process for patterning said upper electrode layer in order to form multiple electrodes corresponding respectively to each said pressure chamber of said pressure chamber forming unit.

9. A piezoelectric actuator manufacturing method as defined in Claim 8, characterized by:

in the second process;

the pliant third sheet in which openings with the predetermined size and shape are provided is piled on one surface side of said first sheet or the other surface side of the second sheet, and said third sheet is densified together with said first and the second sheets.

10. A piezoelectric actuator manufacturing method as defined in Claim 8, characterized by:

in said fourth process;

one surface side of said first sheet is conducted the patterning together with said upper electrode layer so that it will be separated corresponding respectively to each said pressure chamber of said pressure chamber forming unit.

11. A piezoelectric actuator manufacturing method as defined in Claim 8, characterized by:

in said first process;

piezoelectric material is used as said material of the second sheet and electrode layer for polarization formed of conduction material is formed on the other surface side of said second sheet; and

in said third process;

by placing voltage between said upper electrode layer and said electrode layer for polarization, said first sheet is polarized in the direction of its thickness.

12. A piezoelectric actuator manufacturing method as defined in Claim 8, characterized by:

in said first process;

ceramic materials will be used as said material of the second sheet.

13. An piezoelectric actuator manufacturing method as defined in Claim 8, characterized by:

in said first process;

said lower electrode layer is formed thicker than said upper electrode layer; and

the other surface side of said lower electrode layer will be given the function as the vibrating means for generating said pressure for ejecting said ink in said pressure chamber.

14. A piezoelectric actuator manufacturing method, comprising:

the first process for forming multi-layer plate on which the upper electrode layer formed of conduction material is laminated on one surface of the piezoelectric layer formed of piezoelectric material and laminating and the vibration layer formed of

prescribed material is laminated on the other surface of said piezoelectric layer through the lower electrode layer formed of conduction material, and for laminating and forming the reinforcement layer having the prescribed strength in which openings having the prescribed size and shape are provided on one surface side or the other surface side of said multi-layer plate together with said multi-layer plate;

the second process for applying the prescribed processing to said multi-layer plate; and

the third process for separating the available part of said multi-layer plate exposing from said openings of said reinforcement layer from the other part of said multi-layer plate.

15. An ink-jet printhead, comprising:

a pressure chamber forming unit in which pressure chambers for ink storage composed of multiple concave parts on one surface; and

a piezoelectric actuator arranged on one surface of said pressure chamber forming unit and for generating pressure in each said pressure chamber selectively; and

said piezoelectric actuator, comprising:

a vibration layer arranged on one surface of said pressure chamber forming unit covering each said pressure chamber;

a lower electrode layer formed of conduction materials laminated on said vibration layer;

the first piezoelectric layer formed of piezoelectric materials polarized in the direction of its thickness, having the size to cover multiple said pressure chambers and laminated on said lower electrode layer; and

an upper electrode layer formed of conduction materials laminated on said first piezoelectric layer; and characterized by:

at least either said upper electrode layer or said lower electrode layer is formed of multiple electrodes separated and formed corresponding to each said pressure chamber of the pressure chamber forming unit.

16. An ink-jet printhead as defined in Claim 15, characterized by:

said vibration layer, said lower electrode layer, said first piezoelectric layer and said upper electrode layer of said piezoelectric actuator are directly laminated and formed using the prescribed multi-layer manufacturing process successively.

17. An ink-jet printhead as defined in Claim 15, characterized by:

one surface side of said first piezoelectric layer on which said upper electrode layer is laminated is separated corresponding to each said electrode of said upper electrode layer and/or said lower electrode layer.

18. An ink-jet printhead as defined in Claim 15, characterized by:

said vibration layer of the piezoelectric actuator comprising:

the second piezoelectric layer formed of piezoelectric materials laminated under said lower electrode layer.

19. An ink-jet printhead as defined in Claim 15, characterized by:

said vibration layer of the piezoelectric actuator comprising:

electrode layer formed of conduction materials laminated under the second piezoelectric layer.

20. An ink-jet printhead as defined in Claim 15, characterized by:

said vibration layer of the piezoelectric actuator, comprising:

ceramic layer formed of ceramic materials laminated under said lower electrode layer.

21. An ink-jet printhead as defined in Claim 15, characterized by:

said vibration layer of the piezoelectric actuator is comprised of a part of said lower electrode layer.